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Getting Together for Computing Cross-fertilization and Broader Participation

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ABSTRACT

This paper briefly presents the diversity and quality of the work presented by distinguished speakers, from academia and industry, at the 2021 Inaugural OkIP Academia & Industry Convention. Speakers' short biography is also presented. For maximum cross-fertilization and broader participation, they talked in various areas of computing, including (1) threat modeling and machine learning, (2) sustainable energy harvesting and wireless power transfer systems, (3) blockchain technology and its implications in business applications and healthcare IT, (4) biosensors in a green economy, and (5) software engineering body of knowledge guide.

Keywords: Machine Learning, Wireless Power Transfer, Blockchain Technology, Green Economy, Software Engineering Education

I. INTRODUCTION

Distinguished speakers at the 2021 Inaugural OkIP Academia & Industry Convention presented in various areas of computing, including (1) threat modeling and machine learning, (2) sustainable energy harvesting and wireless power transfer systems, (3) blockchain technology and its implications in business applications and healthcare IT, (4) biosensors in a green economy, and (5) software engineering body of knowledge guide. More information on each of their talk follows.

II. THREAT MODELING AND MACHINE LEARNING

Below we provide the abstract of the work presented and a short biography of Dr. Nancy R. Mead.

A. Challenges and Perspectives

This talk focused on recent threat modeling research as it relates to machine learning. After briefly revisiting our prior threat modeling research (Mead, Hough & Stehney, 2005; Mead & Woody, 2016), newer results from a student project on machine learning were discussed. Recently, we have been considering the use of machine learning to identify attacker types in specific domains. So, on the one hand, we examined whether machine learning models are vulnerable to attack, and on the other hand, whether machine learning can help to identify attacker types.

B. Dr. Nancy R. Mead's Short Biography

Dr. Nancy R. Mead is a Fellow of the Software Engineering Institute (SEI) and an Adjunct Professor of Software Engineering at Carnegie Mellon University. Her research areas are security requirements engineering and software assurance curricula. The Nancy Mead Award for Excellence in Software Engineering Education is named for her.

Before joining the SEI, Mead was a senior technical staff member at IBM Federal Systems, where she spent most of her career developing and managing large real-time systems. She also worked in IBM's software engineering technology area and managed IBM Federal Systems' software engineering education department. She has developed and taught numerous courses on software engineering topics, both at universities and in professional education courses.

Mead has more than 150 publications and invited presentations. She is a Life Fellow of the IEEE, a Distinguished Member of the ACM, and was named the 2015 Distinguished Educator by IEEE TCSE. Dr. Mead received her Ph.D. in mathematics from the Polytechnic Institute of New York.

III. SUSTAINABLE ENERGY HARVESTING AND WIRELESS POWER TRANSFER SYSTEMS

Below we provide the abstract of the work presented and a short biography of Prof. Manos M. Tentzeris.

A. Challenges and Perspectives

In this talk, inkjet-/3D printed antennas, interconnects, "smart" encapsulation and packages, RF electronics, microfluidics and sensors fabricated on glass, PET, paper and other flexible substrates was introduced as a system-level solution for ultra-low-cost mass production of Millimeter-Wave Modules for Communication, Energy Harvesting and Sensing applications (Eid & al., 2020). Prof. Tentzeris touched up the state-of-the-art area of fully-integrated printable broadband wireless modules covering characterization of 3D printed materials up to E-band, novel printable "ramp" interconnects and cavities for IC embedding as well as printable structures for self-diagnostic and anti-counterfeiting packages.

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The presented approach could potentially set the foundation for the truly convergent wireless sensor ad-hoc networks of the future with enhanced cognitive intelligence and "rugged" packaging. Prof. Tentzeris discussed issues concerning the power sources of "near- perpetual" RF modules, including state-of-the-art flexible miniaturized enhanced-output and enhanced-range ambient energy harvesters up to above 5G mmW frequencies.

The final step of the presentation involved examples from shape-changing 4D-printed (origami) packages, reflectarrays, and mmW wearable (e.g.biomonitoring) antennas and RF modules (Palazzi & al., 2021). Special attention was paid on the integration of ultra-broadband (Gb/sec) inkjet-printed nanotechnology-based backscattering communication modules as well as miniaturized printable wireless (e.g. CNT) sensors for Internet of Things (IoT), 5G (Eid & al., 2021), and smart agriculture/biomonitoring applications. It has to be noted that the talk reviewed and presented challenges for inkjet-printed organic active and nonlinear devices as well as future directions in the area of environmentally-friendly ("green") RF electronics and "smart-skin' conformal sensors.

B. Dr. Manos M. Tentzeris's Short Biography

Dr. Tentzeris is currently a Ken Byers Professor in flexible electronics and served as the Head of the Electromagnetics Technical Interest Group with the School of ECE, Georgia Tech. He is also the Head of the A.T.H.E.N.A. Research Group (20 students and researchers) and has established academic programs in 3D Printed RF electronics and modules, flexible electronics, origami and morphing electromagnetics, Highly Integrated/Multilayer Packaging for RF and Wireless Applications using ceramic and organic flexible materials, paper-based RFIDs and sensors, inkjet-printed electronics, nanostructures for RF, wireless sensors, power scavenging, and wireless power transfer, Microwave MEM's, SOP-integrated (UWB, multiband, conformal) antennas and Adaptive Numerical Electromagnetics (FDTD, MultiResolution Algorithms).

He has published more than 600 papers in refereed Journals and Conference Proceedings, 5 books, and 25 book chapters. He is a Fellow of IEEE, a member of MTT-15 Committee, an Associate Member of the European Microwave Association (EuMA), a Fellow of the Electromagnetics Academy, and a member of Commission D, URSI, and of the Technical Chamber of Greece. Professor Tentzeris received his M.S. and Ph.D. degrees in Electrical Engineering and Computer Science from the University of Michigan, Ann Arbor, in 1993 and 1998.

IV. Blockchain Technology and its Implications in Business Applications and Healthcare IT

Below we provide the abstract of the work presented and a short biography of Prof. Akhil Kumar.

A. Challenges and Perspectives

Blockchain technology has become popular in a variety of application areas. Some people assume that blockchain is a solution for every problem in the world. In this talk, I first gave an overview of blockchain technology. Next, I discussed how blockchain could be used in business in the context of supply chains and the implications of doing so (Kumar, Liu & Shan, 2020). Later, I devoted some time to discussing how blockchains would fit in the context of healthcare applications (Kumar & Zhao, 2013). I hope the audience has gained a somewhat balanced perspective on the strengths and drawbacks of this new technology.

B. Dr. Akhil Kumar's Short Biography

Dr. Akhil Kumar currently a Professor of Information Systems, joined the Smeal College of Business at Penn State University in June 2002. He has previously been on the faculties at Cornell University and the University of Colorado and has spent a sabbatical year as a scientist at Bell Labs, Murray Hill, NJ. He has published more than 100 papers in academic journals and international conferences.

Akhil currently serves as an associate editor for ACM Transactions on Management Information Systems. Previously, he was an associate editor for IEEE Transactions on Services Computing, INFORMS Journal on Computing and Information Systems Research. He was a program co-chair of BPM 2017 Conference. He also served as a co-program chair of CoopIS'11 and co-chair of Workshop on Information Technologies and Systems (WITS'07). He has been a principal investigator for National Science Foundation and received support from IBM, Sun Microsystems, and other organizations. He is a senior member of IEEE and a member of ACM.

His current research interests are in Blockchain technology, Business analytics, Deep learning, Health IT and Healthcare forums, BPM and workflow systems, and process mining. He received his Ph.D. from Berkeley in 1988.

V. The Role of Biosensors in a Green Economy

Below we provide the abstract of the work presented and a short biography of Mr. Tom Jobe.

A. Challenges and Perspectives

This talk described how the numerous forms of biosensors perform necessary functions in research, medicine and industrial uses (Garipcan & al., 2011). It presented recent developments (Shrikrishna & al., 2021) that allow biosensors to be used to reduce resources in power, materials, and costs while improving our quality of life.

B. Mr. Tom Jobe's Short Biography

Mr. Jobe spent 10 years in the energy business as an instrument developer before moving to Corazonix of OKC in 1987 to develop hi-res ECG equipment. In 1990, he began a 15-year career as developer and manager of medical diagnostic instruments with Organon Teknika & BioMerieux, where he led the development of microbiology, coagulation, and nucleic acid diagnostics instrumentation.

In 2005, he became the Business Manager for the SensiQ division of Nomadics, directing the development of biosensor-based Life Science equipment for pharma and biotechnology applications. After SensiQ spun out of Nomadics to become SensiQ Technologies, he directed the company's R&D, manufacturing, and commercialization efforts as Chief Operating Officer. After SensiQ Technologies was acquired by

Pall Life Sciences in 2017, Mr. Jobe co-founded startups BioInSpire of Oklahoma City and Essai Sciences of Stillwater.

BioInSpire provides consulting services to Life Sciences clients, while Essai Sciences provides biomolecular interaction analysis services of pharmaceutical compounds. He has served on the Engineering Industry Advisory Boards at the University of Central Oklahoma, OSU-OKC, and the Stephenson School of Biomedical Engineering at OU-Norman. He served as a Distinguished Lecturer for the IEEE Engineering in Medicine and Biology Society for 2016-2018, providing lectures related to the field of biosensors. Mr. Jobe holds BS and MS Engineering degrees from Oklahoma State University.

VI. The Software Engineering Body of Knowledge Guide—More Than 20 Years Down the Road

Below we provide the abstract of the work presented and a short biography of Dr. Pierre Bourque.

A. Challenges and Perspectives

The proof of concept document of the Guide to the Software Engineering Body of Knowledge (SWEBOK) was made available in 1998—now more than 20 years ago. The keynote speaker has played a key role in all published versions of the SWEBOK Guide (Ardis & al., 2011; Guide, 2014). In this talk, the speaker reflected on the impact of the SWEBOK Guide, made some observations about its current content after recently spending a year in the industry, and provided some remarks on moving forward.

B. Dr. Pierre Bourque's Short Biography

Pierre Bourque is a Full Professor in the Department of Software and IT Engineering at École de technologie supérieure of the Université du Québec. He is also the Director of the Master in Software Engineering program (2005 to 2013, 2021-). After having completed two terms as Dean of Studies of his school (2013-2016, 2016-2019), he completed in 2019-2020 an industrial assignment at CGI during his year on administrative (sabbatical) leave. He teaches undergraduate and graduate courses in software requirements. He is the 2020 recipient of the Nancy Mead Award for Excellence in Software Engineering Education.

Pierre Bourque is a member of the Canadian Engineering Accreditation Board (CEAB) (2020-2023). He is also the lead co-editor of the Guide to the Software Engineering Body of Knowledge (SWEBOK) V3 published in 2014 and was co-editor of the 2001 and 2004 versions of the SWEBOK Guide. The SWEBOK Guide is also recognized as an ISO/IEC Technical Report. He was named to the Board of Governors of the IEEE Computer Society in 2010 and was an elected member for the periods of 2011-2013 and 2014-2016.

VII. Conclusion

The above talks were in (1) threat modeling and machine learning, (2) sustainable energy harvesting and wireless power transfer systems, (3) blockchain technology and its implications in business applications and healthcare IT, (4) biosensors in a green economy, and (5) software engineering body of knowledge guide. Their content, audience participation, and quality of speakers have helped maximize cross-fertilizations of new research ideas and broader overall involvement.

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